

8. Theory of Cost

The term '**cost**' means the amount of expenses [actual or notional] incurred on or attributable to specified thing or activity.

“ As per Institute of cost and work accounts (ICWA) India, Cost is 'measurement in monetary terms of the amount of resources used for the purpose of production of goods or rendering services.

Term cost is used in this very form. In reference to production/manufacturing of goods and services cost refers to sum total of the value of resources used like raw material and labour and expenses incurred in producing or manufacturing of given quantity.

The cost concept that are relevant to business operation and decisions can be categories.

- Cost concept used for accounting purpose
- Analytical cost concept used in Economics analysis

Classification of Cost



(A) Opportunity Cost and Actual Cost

The opportunity cost is the opportunity loss. Resources available to any person firm or society are scarce but alternative uses with different returns. It is defined as the expected returns from the second best use of the resources that are forgone due to scarcity of resources. The opportunity cost is also called alternative cost.

Actual costs are those costs, which a firm incurs while producing or acquiring a good or service like raw materials, labour, rent, etc. Suppose, we pay Rs. 150 per day to a worker whom we employ for 10 days, then the cost of labour is Rs. 150. Sometimes the actual costs are also called acquisition costs or outlay cost.

(B) Business Cost and Full Cost

Business Cost includes all the payment and contractual obligations made by the firm together with the book cost of depreciation on plant and equipment. It is used for calculating business profit and losses.

Full Cost means business cost, opportunity cost and normal profit.

(C) Explicit and Implicit Cost

Explicit costs are those payments that must be made to the factors hired from outside the control of the firm. They are the monetary payments made by the entrepreneur for purchasing or hiring the services of various productive factors which do not belong to him. Such payments as rent, wages, interest, salaries, payment for raw materials, fuel, power, insurance premium, etc. are examples of explicit costs.

Implicit costs refer to the payments made to the self-owned resources used in production. They are the earnings of owner's resources employed in their best alternative uses. For example, a businessman utilizes his services in his own business leaving his job as a manager in a company.

(D) Out of Pocket and Book Cost

Out of pocket costs are those costs that involve current cash payments to outsiders. For example, wages and salaries paid to the employees are out-of pocket costs. Other examples of out-of-pocket costs are payment of rent, interest, transport charges, etc.

Book costs are those business costs, which do not involve any cash payments but for them a provision is made in the books of account to include them in profit and loss accounts and take tax advantages. For example, salary of owner manager, if not paid, is a book cost

(E) Historical Costs and Replacement Costs

Historical cost or original costs of an asset refer to the original price paid by the management to purchase it in the past.

Whereas **replacement costs** refers to the cost that a firm incurs to replace or acquire the same asset now. The distinction between the historical cost and the replacement cost result from the changes of prices over time. In conventional financial accounts, the value of an asset is shown at their historical costs but in decision-making the firm needs to adjust them to reflect price level changes.

(F) Controllable and Uncontrolled Costs

Controllable costs are those which can be controlled or regulated through observation by an executive and therefore they can be used for assessing the efficiency of the executive. Most of the costs are controllable.

Example : Inventory costs can be controlled at the shop level etc.

Uncontrollable Costs The costs which cannot be subjected to administrative control and supervision are called non controllable costs.

Example : Costs due obsolescence and depreciation, capital costs etc.

(G) Sunk Costs and Incremental Costs

Sunk cost are those which are made once and for all and can not be altered, increased or decreased by varying the rate of output nor can they be recovered. For example, the purchase of specialized equipment designed to order for a plant. We assume that the equipment can be used to do only what it was originally designed for and cannot be converted for

alternative use. The expenditure on this equipment is a sunk cost, because this equipment has no alternative use its opportunity cost is zero and, hence, sunk costs are not relevant to economic decisions.

The concept of incremental cost is based on the fact that, in the real world, it is not practicable to employ factors for each unit of output separately due to lack of perfect divisibility of inputs. It also arises as a result of change in product line, addition or introduction of a new product, replacement of worn out plant and machinery, replacement of old technique of production with a new one, and the like.

(H) Fixed and Variable Costs

Costs that are fixed in volume for a certain level of output they do not vary with output. They remain constant regardless of the level of output. Fixed costs include: (i) **Cost of managerial and administrative staff**; (ii) **Depreciation of machinery**; (iii) **Land, maintenance**. Fixed costs are normally short-term concepts because, in the long run, all costs must vary.

Variable Costs are those that vary with variations in output. It includes: (i) **Cost of raw materials**; (ii) **Running costs of fixed capital, such as fuel, repairs, routine maintenance expenditure, direct labour charges associated with output levels**; and (iii) **The Costs of all other inputs that may vary with the level of output**.

(I) Total Cost, Average Cost and Marginal Cost

Total cost (TC) refers to the money value of the total resources/inputs required for the production of goods and services by the firm. In other words, it refers to the total outlays of money expenditure, both explicit and implicit, on the resources used to produce a given level output. Total cost includes both fixed and variable costs and is given by

$$TC = VC + FC$$

Average Cost (AC) refers to the cost per unit of output assuming that production of each unit incurs the same cost. It is statistical in nature and is not an actual cost. It is obtained by dividing Total Cost (TC) by Total Output (Q).

$$AC = \frac{TC}{Q}$$

Marginal costs (MC), refers to the additional costs that are incurred when there is an addition to the existing output level of goods and services. In other words, it is the addition to the Total Cost (TC) on account of producing additional units.

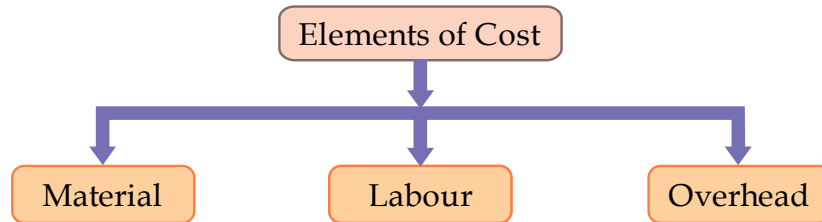
(J) Short Run Cost and Long Run Cost

Both short run and long run costs are related to fixed and variable costs and are often used in economic analysis.

Short Run Cost : These costs are which vary with the variation in the output with size of the firm. Short run costs are same as variable costs. Broadly, short run costs are associated with variable inputs in the utilization of fixed plant or other requirements.

Long Run Cost : These costs are which incurred on the fixed assets like land and building, plant and machinery etc., Long run costs are same as fixed costs. Usually, long run costs are associated with variations in size and kind of plant.

Elements of Cost



Cost Function

The cost function refers to mathematically relation between cost of a product and the various determines of costs.



$$C = F(Q, T, P_f, K)$$

where $C = \text{Total Cost}$
 $Q = \text{Quantity Produced i.e. output}$
 $T = \text{Technology}$
 $P_f = \text{Factor Price}$
 $K = \text{Capital}$

Short Run Cost Function

Short Run Cost can be divided

- Fixed Cost
- Variable Cost
- Total Cost

Short Run Fixed Cost

$$C = f(Q)$$

Long Run Cost Function

$$C = f(Q, T, P_f, K)$$

Short Run Cost :

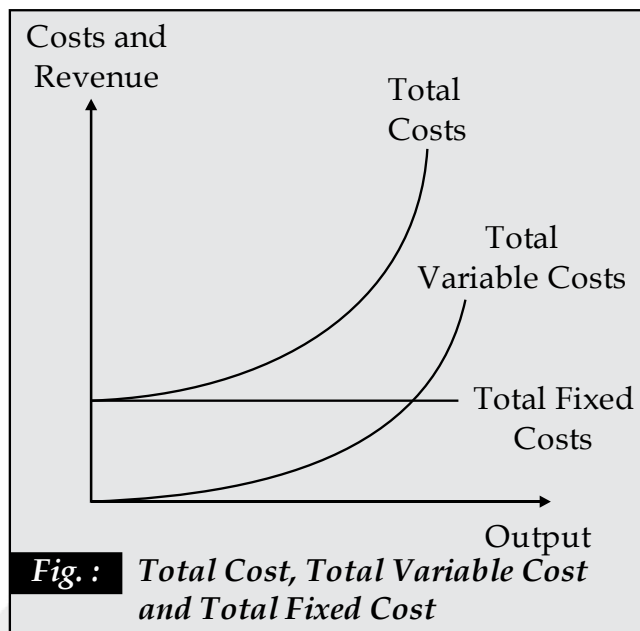
(a) **Total Fixed Cost** : Given that **total fixed costs (TFC)** are constant as output increases, the curve is a horizontal line on the cost graph.

(b) **Total Variable Costs** : The **total variable cost (TVC)** curve slopes up at an accelerating rate, reflecting the law of diminishing marginal returns.

(c) **Total Costs** : The **total cost (TC)** curve is found by adding total fixed and total variable costs. Its position reflects the amount of fixed costs, and its gradient reflects variable costs.

Output	Total Fixed Cost	Total Variable Cost	Total Cost
1	100	50	150
2	100	80	180
3	100	100	200
4	100	110	210
5	100	150	250
6	100	200	320
7	100	350	450
8	100	640	740

Plotting this gives us Total Cost, Total Variable Cost, and Total Fixed Cost.



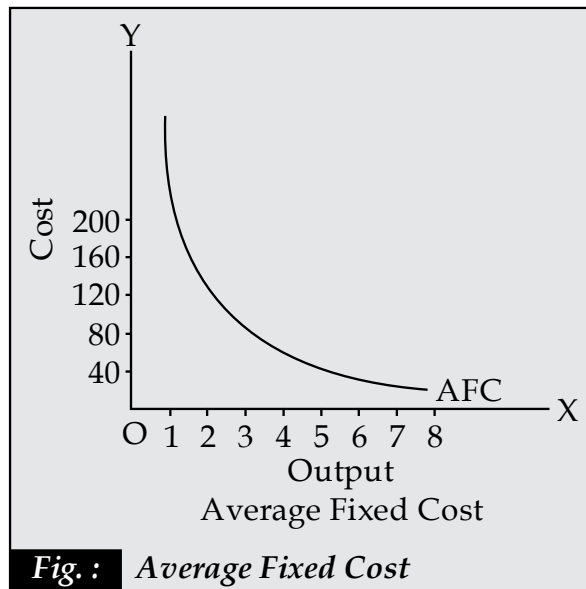
Average Fixed Cost, Average Variable Cost and Average Total Cost

(a) Average Fixed Cost : It is the total fixed cost (TFC) divided by the number of units of output produced. It is referred to as "Fixed Cost per Unit output". The AFC curve is therefore an onward sloping curve.

$$AFC = \frac{\text{Total Fixed Cost}}{\text{Unit of Output}}$$

(As output approaches Zero, average fixed cost approaches infinity, but AFC curve never touches the Y-axis. On the other hand, as output reaches very high levels, average fixed cost approaches zero, but it never reduces itself to zero, it always remains positive. Hence the AFC curve never touches the X-axis also. Thus it follows that AFC curve never touches either of the axis. Actually this curve takes the shape of rectangular hyperbola, which shows that the area under the curve (i.e., total fixed cost) always remains the same. AFC is illustrated in the following table and diagram.

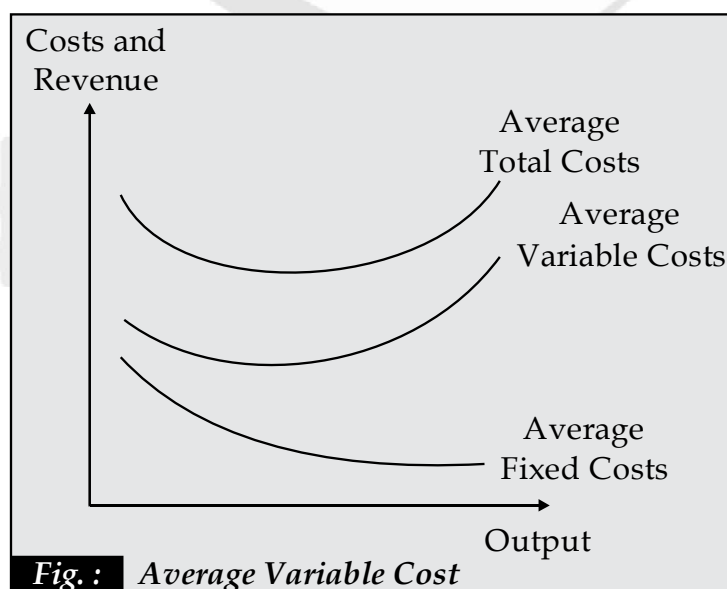
Output	Total Fixed Cost	Average Fixed Cost
1	100	100
2	100	50
3	100	33.3
4	100	25
5	100	20
6	100	16.6
7	100	14.3
8	100	12.5



(b) Average Variable Cost : It is referred to as "**Variable Cost per Unit of Output**". The Average variable costs will come down and then rise as more and more units are produced with a given plant. This is because as we add more units of variable factors in a fixed plant, the efficiency of the inputs first increases then it decreases.

Average variable cost can be obtained by dividing total fixed cost (TFC) by the quantity of output (Q).

Output	Total Variable Cost	Average Variable Cost
1	50	50
2	80	40
3	100	33.3
4	110	27.5
5	150	30
6	220	36.7
7	350	50
8	640	80



(c) Average Total Cost : Average total cost (ATC) is also called average cost or unit cost. Average total costs are a key cost in the theory of the firm because they indicate how efficiently scarce resources are being used. Average variable costs are found by dividing total fixed variable costs by output.

Output	Average Fixed Cost	Average Variable Cost	Average Total Cost
1	100	50	150
2	50	40	90
3	33.3	33.3	67
4	25	27.5	52.5
5	20	30	50
6	16.6	36.7	53.3
7	14.3	50	64.3
8	12.5	80	92.5

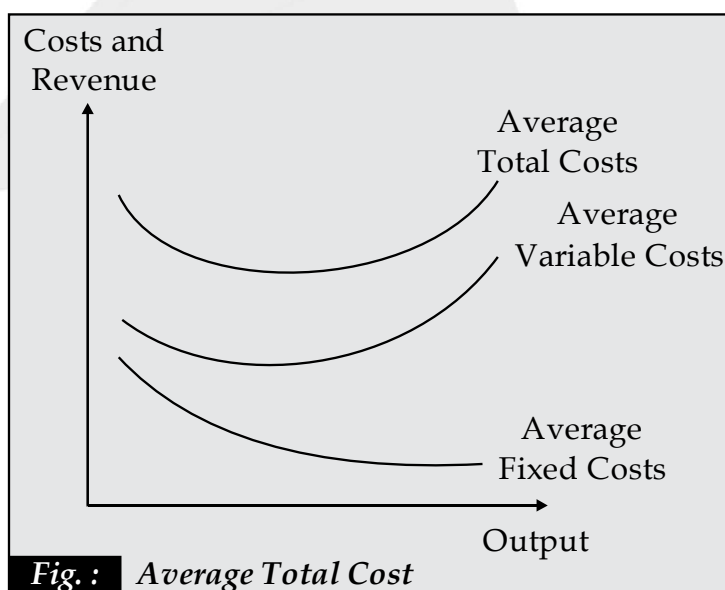


Fig. : Average Total Cost

The inter-relationship between AVC, ATC and AFC can be summed up as follows:

- If both AFC and AVC fall, ATC will fall.
- If AFC falls but AVC rises;
- ATC will fall where the drop in AFC is more than the rise in AVC.
- ATC will not fall where the drop in AFC is equal to the rise in AVC.
- ATC will rise where the drop in AFC is less than the rise in AVC.

Marginal Cost

The marginal cost is the cost of producing one more unit of a good. Marginal cost includes all of the costs that vary with the level of production. For example, if a company needs to build a new factory in order to produce more goods, the cost of building the factory is a marginal cost.

Marginal cost is the change in total cost when another unit is produced; average cost is the total cost divided by the number of goods produced. It is important to note that marginal cost is derived solely from variable costs, and not fixed costs.

The marginal cost curve falls briefly at first, and then rises. Marginal costs are derived from variable costs and are subject to the principle of variable proportions.

Output	Total Cost	Marginal Cost
1	150	
2	180	30
3	200	20
4	210	10
5	250	40
6	320	70
7	450	130
8	740	290

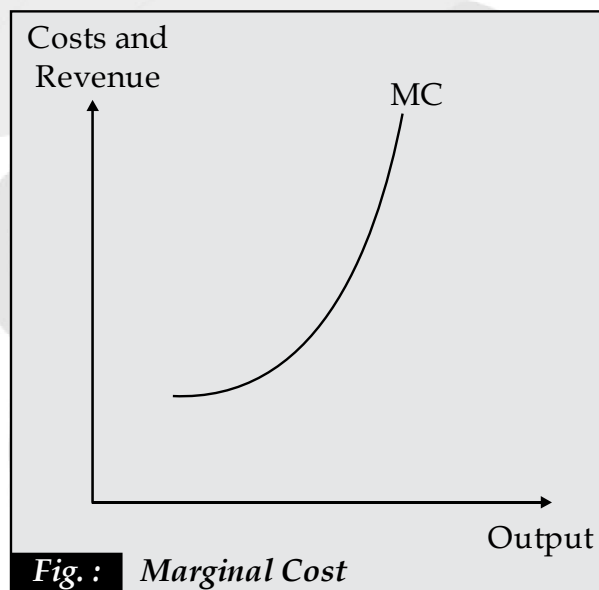


Fig. : Marginal Cost

Simultaneous Presentation of Average and Marginal Costs

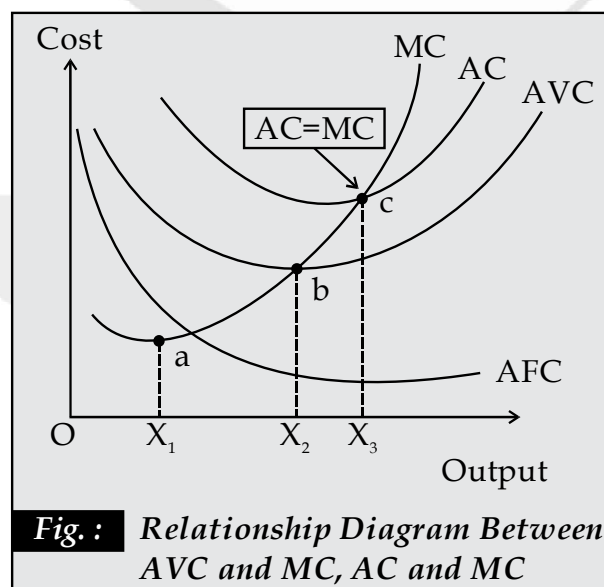


Fig. : Relationship Diagram Between AVC and MC, AC and MC

Relationship between AC and MC

- Both AC and MC curves are u-shaped, reflecting the law of variable proportion.
- When AC is falling, then MC is below AC.
- When AC is rising, then MC is above AC.
- When AC is neither falling nor rising, then $MC = AC$ (Point C).
- MC curve cuts the AC curve at its minimum point.

Relationship between AVC and MC

- Both AVC and MC curves are u-shaped reflecting the law of variable proportion.
- When AVC is falling, MC is below AVC.
- When AVC is rising, MC is above AVC.
- When AVC is neither falling nor rising, then $MC = AVC$ (point b).
- The minimum point of AVC curve (point b) will always occur to the right of the minimum point of MC curve (point a).
- There is range over which AVC is falling and MC is rising.

Long Run Cost

Long Run is a period of Time during which the firm can vary of all of its input. The firm moves for more plant to another in long run. To increase the output firm acquires Big plant and Vice Versa.

Long run cost of production is the least possible cost of producing any given level of output when all individuals factors are variable.

The long run cost curve of a firm is sometimes called an 'envelope' curve. Consider the different ways that capital intensive and labour intensive industries develop. First, some definitions :

- **Capital-Intensive Firm** : Firm where its cost structure is dominated by fixed costs.
- **Labour Intensive Firm** : Firm where its cost structure is dominated by variable costs (this may be, but does not have to be labour).
- **Cost structure** : The relationship between fixed and variable costs for a firm.

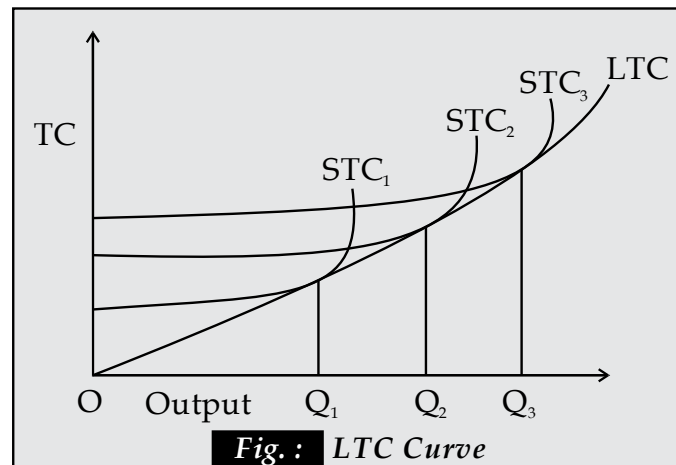
In the long run, all the factors of production used by an organization vary. The existing size of the plant or building can be increased in case of long run.

There are no fixed inputs or costs in the long run. Long run is a period in which all the costs change as all the factors of production are variable.

There is no distinction between the Long run Total Costs (LTC) and long run variable cost as there are no fixed costs. It should be noted that the ability of an organization of changing inputs enables it to produce at lower cost in the long run.

1. Long Run Total Cost

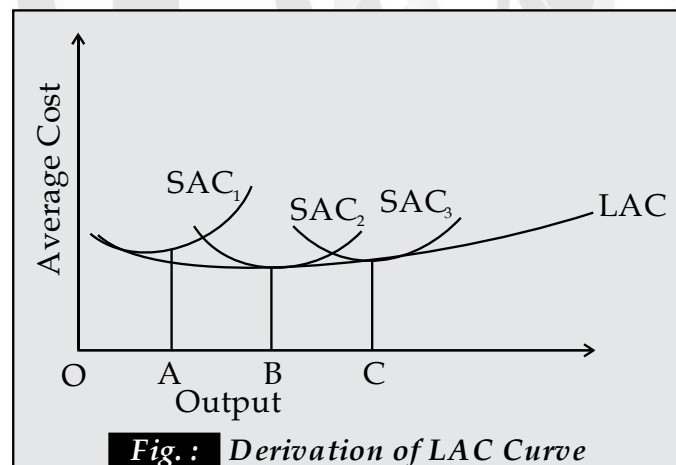
Long run Total Cost (LTC) refers to the minimum cost at which given level of output can be produced. According to Leibhafasky, "the long run total cost of production is the least possible cost of producing any given level of output when all inputs are variable." LTC represents the least cost of different quantities of output. LTC is always less than or equal to short run total cost, but it is never more than short run cost.



As shown in Figure, short run total costs curves; STC_1 , STC_2 , and STC_3 are shown depicting different plant sizes. The LTC curve is made by joining the minimum points of short run total cost curves. Therefore, LTC envelopes the STC curves.

2. Long Run Average Cost

Long run Average Cost (LAC) is equal to long run total costs divided by the level of output. The derivation of long run average costs is done from the short run average cost curves. In the short run, plant is fixed and each short run curve corresponds to a particular plant. The long run average costs curve is also called planning curve or envelope curve as it helps in making organizational plans for expanding production and achieving minimum cost.



Suppose there are three sizes of the plant and no other size of the plant can be built. In short run, the plant sizes are fixed thus, organization increase or decrease the variable factors. However, in the long run, the organization can select among the plants which help in achieving minimum possible cost at a given level of output.

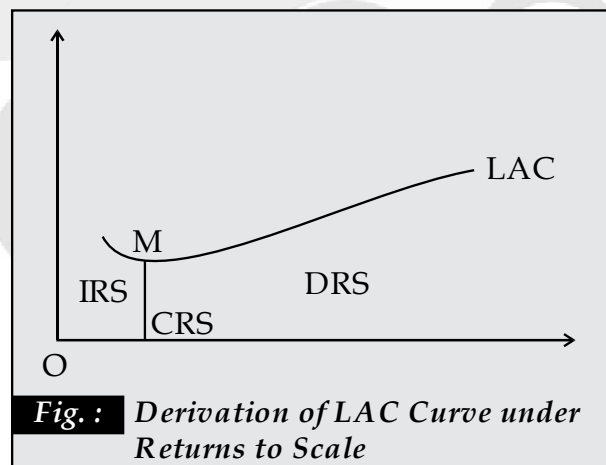
From Figure, it can be noted that till OB amount of production, it is beneficial for the organization to operate on the plant SAC^2 as it entails lower costs than SAC^1 . If the plant SAC^2 is used for producing OA, then cost incurred would be more. Thus, in the long run, it is clear that the producer would produce till OB on plant SAC^2 . On SAC^2 , the producer would produce till OC amount of output. If an organization wants to exceed output from OC, it will be beneficial to produce at SAC^3 than SAC^2 .

Thus, in the long run, an organization has a choice to use the plant incurring minimum costs at a given output. LAC depicts the lowest possible average cost for producing different levels of output. The LAC curve is derived from joining the lowest minimum costs of the short run average cost curves.

It first falls and then rises, thus it is U-shaped curve. The returns to scale also affect the LTC and LAC. Returns to scale implies a change in output of an organization with a change in inputs. In the long run, the output changes with respect to change in all inputs of production.

In case of increasing returns to scale (IRS), organizations can double the output by using less than twice of inputs. LTC increases less than the increase in the output, thus, LAC falls. In case of constant returns to scale (CRS), organizations can double the output by using inputs twice.

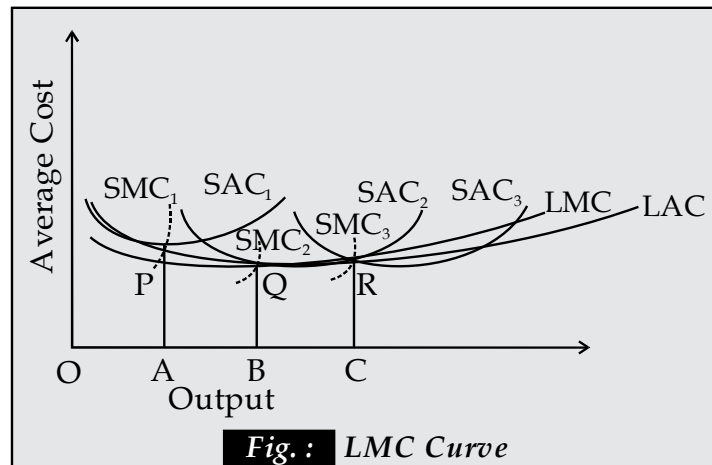
LTC increases proportionately to the output; therefore, LAC becomes constant. On the other hand, in case of decreasing returns to scale (DRS), organizations can double the output by using inputs more than twice. Thus, LTC increases more than the increase in output. As a result, LAC increases.



As shown in Figure, up to M, LAC slopes downward. This is because at this stage IRS is applied. On the other hand, at M, LAC becomes constant. After M, LAC slopes upwards implying DRS.

3. Long Run Marginal Cost

Long run Marginal Cost (LMC) is defined as added cost of producing an additional unit of a commodity when all inputs are variable. This cost is derived from short run marginal cost. On the graph, the LMC is derived from the points of tangency between LAC and SAC.



If perpendiculars are drawn from point A, B, and C, respectively; then they would intersect SMC curves at P, Q, and R respectively. By joining P, Q, and R, the LMC curve would be drawn. It should be noted that LMC equals to SMC, when LMC is tangent to the LAC.

In Fig., OB is the output at which:

$$SAC_2 = SMC_2 = LAC = LMC$$

We can also draw the relation between LMC and LAC as follows :

When $LMC < LAC$, LAC falls

When $LMC = LAC$, LAC is constant

When $LMC > LAC$, LAC rises

Ques. A perfectly competitive firm attains equilibrium when (NTA UGC-NET June 2012 P-III)

- | | |
|---------------|---------------|
| (A) $AC = AR$ | (B) $MR = MC$ |
| (C) $MC = AC$ | (D) $TC = TR$ |

Ans. (B) A perfectly competitive firm attains equilibrium when

1. $MC = MR$
2. MC curve cuts the MR curve from its below.

Ques. The Comparative Cost Advantage Theory was given by (NTA UGC-NET Dec. 2012 P-III)

- | | |
|--------------------|-----------------------|
| (A) David Ricardo | (B) Adam Smith |
| (C) Raymond Vernon | (D) Michael E. Porter |

Ans. (A) The Comparative Cost Advantage Theory was given by David Ricardo

Ques. Given below are two statements, one labelled as Assertion (A) and the other labelled as Reason (R).

Assertion (A) : Only the relevant costs should be taken into consideration for decision making.

Reason (R) : All variable costs are relevant costs and all fixed costs are irrelevant costs.

In the above two statements, which one alternative of the following is correct ?

Codes :

(NTA UGC-NET June 2013 P-III)

- (A) Both (A) and (R) are correct.
- (B) Only (A) is correct, but (R) is wrong.
- (C) Only (R) is correct, but (A) is wrong.
- (D) Both (A) and (R) are wrong.

Ans. (B) Variable costs and decision making—since fixed costs will be incurred regardless of the Outcome of the decision, those costs are not be incurred as a direct result of the decision are considered. And these relevant costs are the variable costs.

Fixed costs can also be relevant if they change due to a decision for example in case of idle capacity.

Ques. **Assertion (A) :** In long run under Perfect Competition all firms invariably get only normal profit.

Reason (R) : All firms incur minimum average cost and incur no selling cost due to absence of product differentiation.

(NTA UGC-NET Dec. 2014 P-III)

Codes :

- (A) Assertion (A) and Reason (R) both are correct.
- (B) Assertion (A) is correct, but Reason (R) is incorrect.
- (C) Assertion (A) is incorrect, but Reason (R) is correct.
- (D) Assertion (A) and Reason (R) both are incorrect.

Ans. (A) Long run equilibrium of firm in at point E where both the conditions of the equilibrium are fulfilled :

- (i) $MR = MC$ and
 - (ii) MC cuts MR from the below
- at this point firms

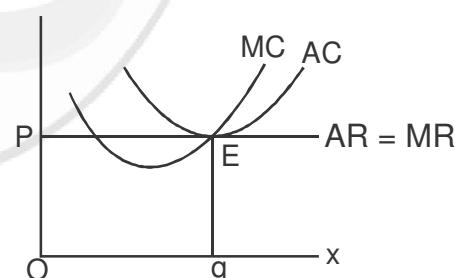
$$\text{Total cost} = Oq \times OP$$

$$\text{Total revenue} = Oq \times OP$$

$$\text{Profit} = \text{Revenue} - \text{Cost}$$

$$= Oq \text{ EP} - Oq \text{ EP}$$

$$= 0 \text{ (Normal Profit)}$$



There is freedom of entry and exit under perfect competition. In situations of extra-normal profit new firms will join the industry. Consequently, market supply will increase. Market price will fall. Extra normal profits will be wiped out. In situations of extra-normal losses, some firms will leave the industry. Consequently, market supply will fall. Market price will rise. Extra-normal profit will disappear. Secondly the average cost is minimum at point E and the firm is bound to sell at the price fixed by the industry. Under perfect competition selling cost is zero.